Radar Pulse (600V/m) Test & Other Immunity Tests

IEEE 802.3dm

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Background

- This presentation contains comparison of the Radiated Immunity Test results for Radar Pulse test and contains a compilation of the various commonly applied immunity tests that have been presented till the July 2025 802.3dm meeting, for both TDD and ACT

- Authors expect that more results are likely to be presented and will update the deck moving forward to continue to provide a comprehensive comparison

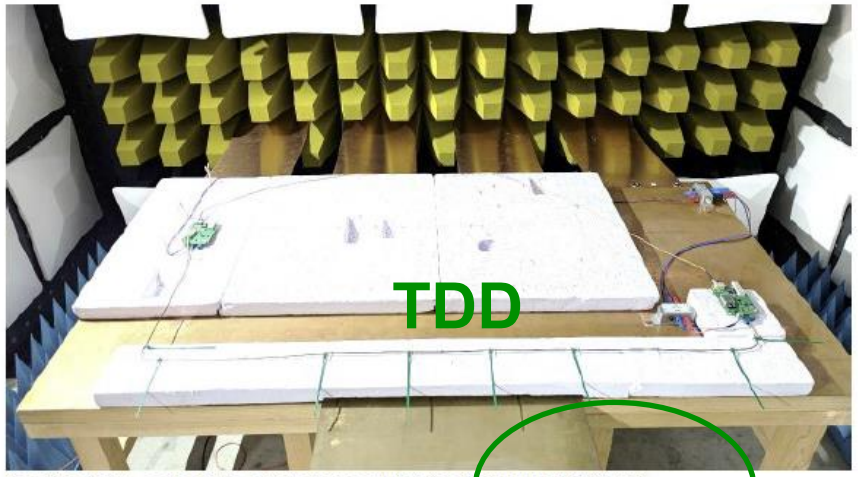
- It can be observed that
  1. For ACT, many key tests for overall immunity are missing
  2. ACT results for Radar test are performed with shorter cable
  3. ACT results for Radar test are not available for commonly used horizontal PCB placement
  4. TDD shows more comprehensive passing results

Presentations referred to in this contribution

- https://www.ieee802.org/3/dm/public/0725/Zerna_3dm_01b_250729.pdf
- https://www.ieee802.org/3/dm/public/0525/Zerna_3dm_01a_150512_EMC_Coax.pdf
- https://www.ieee802.org/3/dm/public/0725/wu_3dm_01a_072925.pdf

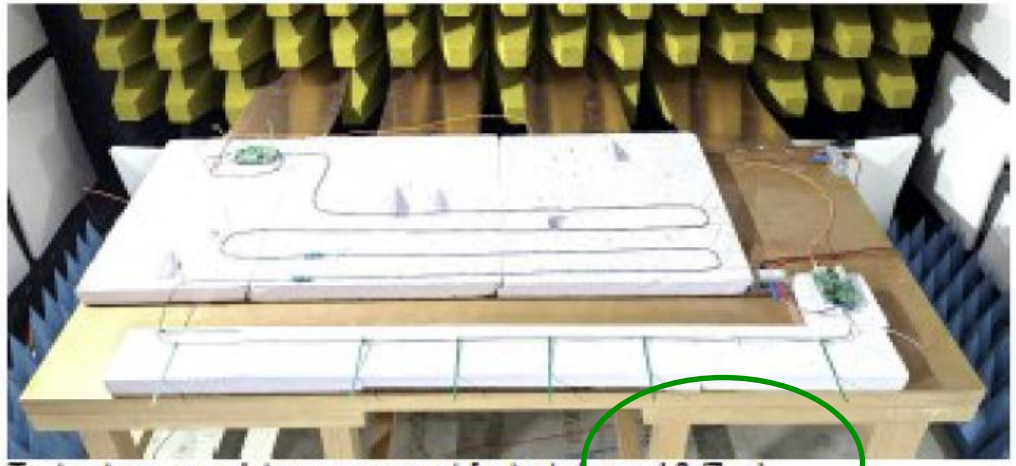
Radiated Immunity – Multiple Cable Lengths

Radiated Immunity – ALSE (2m, 7m and 12m)



Test set-up, complete arrangement for test channel 2 (2 m)

Test parameter			Test result
Frequency range [MHz]	Modula-tion	Data channel	Class IV ISO11452-4
200 to 6000	CW	2 m / no inline connector	Pass
	CW	7 m / 2 inline connector	Pass
	CW	12m / 1 inline connector	Pass



Test set-up, complete arrangement for test channel 3 (7 m)

TDD

ACT: 7 meters Missing

Test set-up, complete arrangement for test channel 1 (12 m)

TDD

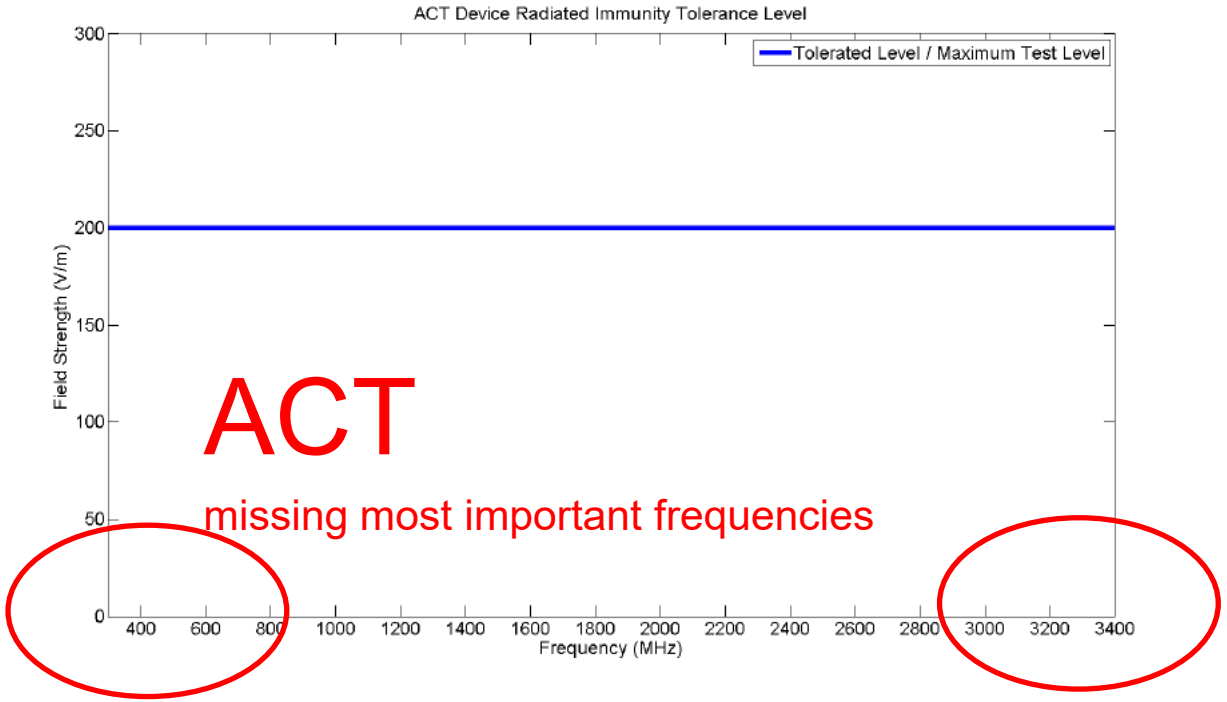
ACT: 12 meters Missing

Radiated Immunity

TDD

shown on previous page (Class IV - Pass) 200MHz to 6GHz

Radiated Immunity Evaluation Result



- This test starts at 200MHz. ACT Results between 200MHz to 350MHz are missing!
- ACT uplink signaling is @ 234MHz. The missing frequency range is critically important!
- ACT results are up to 3.4GHz
- TDD results are up to 6GHz.

BCI Test

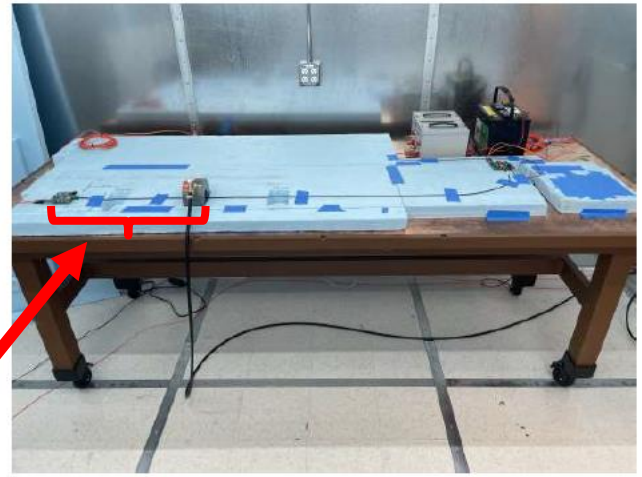
TDD

Test set-up, complete arrangement for test channel 2 (2 m), Deserializer is DUT

channel 2 / 2 m
- connector Rosenberger FAKRA
- cable DACAR 462
- no inline connectors
- segment length: 2 m

15cm!

ACT



Gap is much larger than 15cm!

15 cm is often the hardest to pass. This is due to close proximity of the injector resulting in stronger EM field.

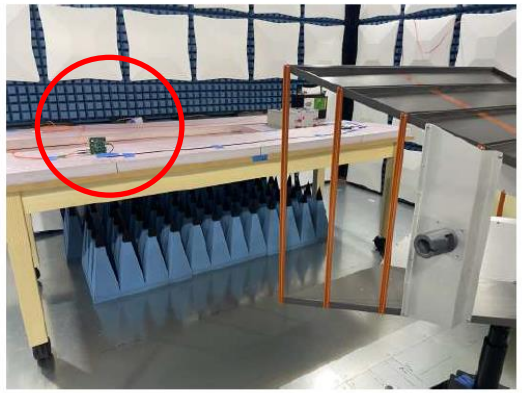
TDD results included 15cm, 45cm & 75cm in the detailed presentation

Overview of CISPR EMC results published till July ‘25

	TDD	ACT
Coax Radiated Immunity	• 2 meter cable – Yes • 7 meter cable – Yes • 12 meter cable – Yes • Complete frequency range	• 2 meter cable – Yes • 7 meter cable – NO • 12 meter cable – NO • Starting near 400MHz, end at 3.4GHz (critical frequencies missing)
Coax BCI	15cm – Yes 45cm – Yes 75cm – Yes	15cm – Not shown in the setup 45cm – Yes 75cm – ?

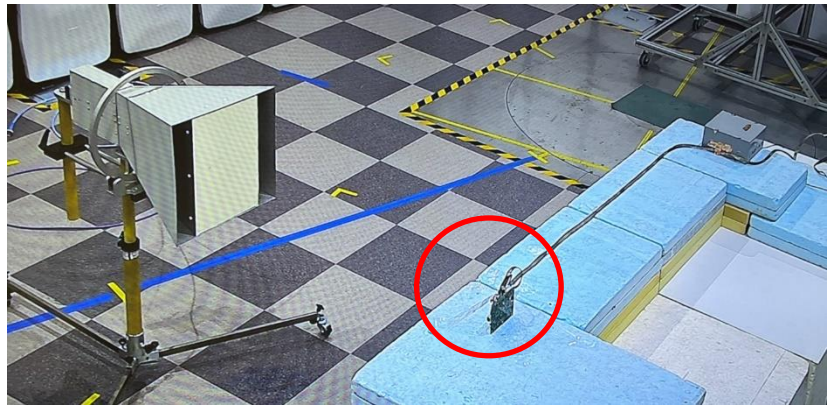
Radar Pulse Test - Setup Details – Test 1

ACT



Antenna Polarization – Not specified
PCB position – Vertical
1.8m
DUT not in metal enclosure

TDD



Antenna Polarization - Horizontal
PCB position – Vertical
3m (2m straight + 1m coiled with DeSer)
DUT not in metal enclosure

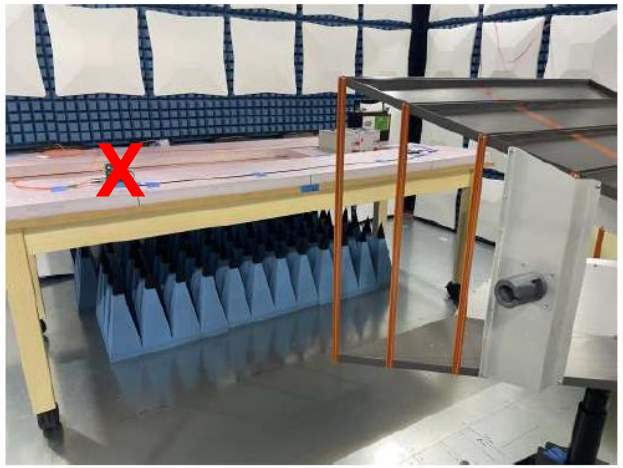
https://www.ieee802.org/3/dm/public/0725/wu_3dm_01a_072925.pdf

Radar Pulse - Test 1 Results

	ACT	TDD
Cable Type	Coax	Coax
Cable Length	1.8 meters	3 meters
PCB placement	Vertical	Vertical
Antenna	Not specified	Horizontal
Power	600V/m	600V/m
Result 1200-1400MHz	Pass (1.8m)	Pass (3m)
Result 2700-3100MHz	Pass (1.8m)	Pass (3m)

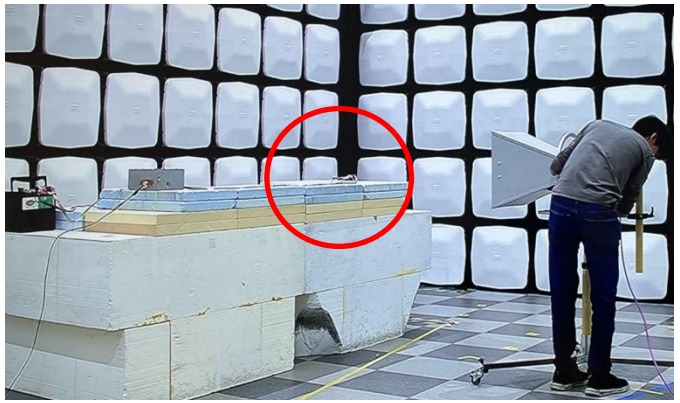
Radar Pulse Test - Setup Details – Test 2

ACT



Antenna Polarization - ?
PCB position – ~~Horizontal~~ (not shown)

TDD



Antenna Polarization - Horizontal
PCB position - Horizontal

Radar Pulse - Test 2 Results

	ACT	TDD
Cable Type	Coax	Coax
Cable Length	N/A	3 meters
PCB placement	N/A	**Horizontal**
Antenna	N/A	Horizontal
Power	600V/m	600V/m
Result 1200-1400MHz	N/A	Pass (3m)
Result 2700-3100MHz	N/A	Pass (3m)

Summary

- This presentation is a comparison of the conducted and radiated immunity results that have been presented till the July 2025 802.3dm meeting

- Authors recognize that more results are likely to be presented and will update the deck moving forward to provide a comprehensive comparison

- For **ACT**, It can be observed that
  1. Many key tests for ***immunity*** are **missing**
     - ***Important frequencies*** are **missing**
     - ***Longer cable lengths*** are **missing**
  2. Radar test results for TDD show
     - 50% longer cable length (3 meters vs 1.8 meters)
     - Both, Horizontal and Vertical PCB placements are demonstrated
  3. ACT tests are ***NOT reported to be from independent test house***

✓ **TDD** results show excellent Immunity performance.

✓ CISPR tests at independent house. 600V/m done at external lab in San Jose, CA.

Thank You